# Line Haul Tug M/V Klihyam Low-NOx Repower Project



Prepared for: BHP Billiton Cabrillo Port Offshore LNG Terminal

Prepared by: OceanAir Environmental, LLC

Report #: OAE-BHP-03

Date: May 2, 2006

### MN KLIHYAM REPOWER PROJECT

## Background

BHP Billiton LNG International, Inc. (BHP) is proposing to build a LNG importation terminal located in Federal waters approximately 14 miles off the Coast of Ventura County. The terminal consists of a Floating Storage and Regasification Unit (FSRU) which is used to store and vaporize liquefied natural gas (LNG). LNG delivered from LNG carriers is offloaded to the FSRU, stored until needed and then regasified. Gas is then transported via two parallel 24-inch pipelines to an onshore facility at Ormand Beach near Oxnard in Ventura County. The project location is 2.06 nautical miles from the edge of shipping channel.

BHP has offered to mitigate the proposed project's NOx emissions by funding engine conversions for third party marine vessels operated along the California Coast. This report identifies one of these vessels, the MN Klihyam, and documents the anticipated emission reductions as a result of the engine repowering as well as the areas where the anticipated emission reductions are expected to occur.

### **Proposed Mitigation Project**

**Project** 

Repower the line haul tug boat M/V Klihyam operated by Sause Brothers, Inc. with low-NOx engines.

### MN Klihyam Details

MN Klihyam details are as follows:

Official number 1084928 Gross tonnage 197 Net tonnage 134 Length 114' 9.5"

## M/V Klihyam Baseline (i.e., Existing) Engines

The M/V Klihyam utilizes two engines for propulsion. Both are Electro-Motive Diesel (EMD) 16-645E6 engines which generate 1,950 h.p. at 900 rpm. The model numbers for each engine are stated below:

S/N Port 81-H1-1055, MY 1981 S/N Starboard 82-M2-1008, MY 1982



# **Project Description**

Sause Brothers, Inc. uses the line haul tug M/V Klihyam primarily to tow the barge Sunset Bay from Richmond to Los Angeles. References to Los Angeles are intended to also include Long Beach and El Segundo. The vessel also occasionally makes trip into Martinez, Benicia, and San Francisco. Sunset Bay barge hauls petroleum products and is equipped with a vapor recovery system. Sunset Bay generators and engines already comply with USEPA Tier II emission limits.

Sause Brothers took over this line haul run in December 2004 and began operation on December 28, 2004. Prior to Sause operation, the service was being provided by Crowley Maritime. Sause Brothers is using the M/V Klihyam for this operation with a combined total horsepower of 3,900.

# Engine Repower

The engine repower project consists of replacing M/V Klihyam's existing diesel propulsion engines (dual EMD12-645E6 engines) with new low-emissions EMD8-710G7B diesel propulsion engines. The 8-710G7B engines are rated at 2,000 h.p. each at 900 rpm. 8-710G7B engines are electronically controlled while the 12-645E6 engines are mechanically controlled. The electronic controls ensure more precise operation and

lower emissions per brake horsepower-hour (bhp-hr). Additionally 8-710G7B engines are more fuel efficient compared to the existing 12-645E6 engines.

### **Emission Reduction Calculations and Documentation**

### a. Historical Operation

M/V Klihyam began operation on December 28, 2004, towing petroleum barge Sunset Bay. Therefore, the evaluation of operating history is limited to this time as the previous route operator's records are not available for inspection. The review consisted of both reviewing the fuel logs and reviewing the trip logs.

The fuel logs document that in 2005 a total of 553,742 gallons of diesel was burned in MN Klihyam. This amount includes 40,000 gallons that was purchased in late December 2004. M/V Klihyam took on 71,000 gallons of fuel on Dec 14, 2004, the majority of which was consumed in January 2005 when the revenue service operation began. OceanAir has conservatively considered only 40,000 gallons out of the 71,000 gallons of fuel to have been burned in January 2005. A summary of the fuel logs is presented in Section D of Attachment A.

The trip logs document that M/V Klihyam took a total of 270 trips. Of this total, 43 were line haul trips (inter-coastal), 144 trips occurred locally within the Los Angeles, El Segundo and Long Beach area, and 83 trips occurred locally within the Richmond, San Francisco, Martinez, Benicia, and Rodeo area. Copies of the actual trip logs are included in Attachment B and a summary of the trip routes, along with distances and trip time, are presented in Section E of Attachment A.

### b. Emission Reduction Calculation Formula

In order to calculate the emission reductions attributable to the MN Klihyam engine repower, OceanAir utilized the equation memorialized in South Coast AQMD Rule 1631(f). Rule 1631 established a program for the generation of mobile source emission reduction credits (MSERCs) through the repowering of diesel-fueled marine vessels. This rule was the subject of prolonged discussion between US EPA Region 9, South Coast AQMD and various stakeholders. This effort generated a rule that took into account multiple perspectives while ensuring a reasonably conservative means of MSERC calculation. This rule has been approved by EPA as part of the California State Implementation Plan. As a result, Rule 1631 is uniquely appropriate for the calculation of the anticipated emission reductions attributable to this marine engine repower project.

Consistent with Rule 1631, the emission reductions attributable to the repowering of MN Klihyam were quantified using the following equation:

ERminyam = (EFbase-EFrepower) x ECF x Fuel Burn /454/2000

### Where:

EFbase Baseline Emission Factor (gms/bhp-hr)

EF
repower = Repower Emission Factor (gms/bhp-hr)

ECF = Energy Consumption Factor (bhp-hr/gal)

The basis for each of these variables is explained below.

### c. Baseline Emission Factor (EFbase)

The baseline emission factor for NOx was taken from 1992 emissions information by EMD, the engine manufacturer, for the 16-645 roots blown engine type. A copy of this specification sheet is included as Attachment C. The PM emission factor was taken from off-road default information for the model year.

## d. Repower Emission Factor (EFrepower)

The repower emission factors were based on the Tier 2 emission limits. As documentation of compliance with these limits, OceanAir has included as Attachment D EMD's Certificate of Conformity.

## e. Energy Consumption Factor (ECF)

The Energy Consumption Factor was derived from information in the EPA 2006 Model Year Certificate of Conformity. Specifically, the brake specific fuel consumption (bsfc) is identified in the Certificate of Conformity Propeller Cube Curve as 0.314 lb/bhp-hr at 900 rpm. At a fuel density of 7.1 lb/gallon, the ECF calculates to 22.61 bhp-hr/gal. This calculation is shown in Section C of Attachment A.

### f. Emission Reduction Calculations

Based on the formula and variables identified above, OceanAir calculated the emission reductions anticipated to result from the repowering of the M/V Klihyam. Details for this calculation are shown in Section C of Attachment A. In total, it is projected that as a result of the MN Klihyam engine repower project NOx emissions in California Coastal Waters will be reduced by 138.71 tons per year and that particulate emissions will be reduced by 4.52 tons per year. Emission reductions by segment and by air district are presented in Sections C.1 and C.2 of Attachment A.

# ATTACHMENT A M/V KLIHYAM EMISSION REDUCTION SUMMARY

# M/V Klihyam Emission Reduction Summary

# A. Trip Logs Summary

Line Haul Distances

16.87%	9.05%	26.75%	12.35%	20.58%	14.40%	
82	44	130	9	100	70	486
SCAQMD Jursidiction	VCAPCD Jurisdiction	SBAPCD Jurisdiction	SLOAPCD	MBUAPCD Jurisdiction	BAAQMD Jurisdiction	

SCAQMD and BAAQMD miles include the turn into the Port

# B. Emission Factors

Reference: GM EMD Manufacturers Specification	Reference: USEPA Tier 2 Emission Limit
15.2 gms/bhp-hr 0.53 gms/bhp-hr 0.94 0.8 14.288 gms/bhp-hr 0.424 gms/bhp-hr	4.87 gms/bhp-hr 0.107 gms/bhp-hr 0.87 0.9 4.2369 gms/bhp-hr 0.0963 gms/bhp-hr
Baseline NOx PM NOX Correction for California fuel PM Correction for California fuel Corrected NOx Corrected PM	Repower NOx PM NOX Correction for California fuel PM Correction for California fuel Corrected NOX Corrected PM

# **Emission Reduction Summary** M/V Klihyam

# C. Emission Reductions

Methodology for calculating emission reductions: SCAQMD Rule 1631 - Pilot Credit Generation Program for Marine Vessels (SIP-approved MSERC calcuation method peer reviewed by USEPA)

(EFbase-EFrepower) x ECF x Fuel Burn / 454/2000 Emission reductions (tons/yr) =

where ECF = Energy Consumption Factor

Reference: GM EMD Manufacturers Specification EFBase = 15.2 gms/bhp-hr

ECF = 22.61 bhp-hr/gal

Reference: USEPA Tier 2 Emission Limit EFrepower = 4. gms/bhp-hr

Reference: ElectroMotive 8-710 Tier 2 Certificate of Conformity 22.61 bhp-hr/gal = 1/(0.314 lb/bhp-hr /7.1 lb/gal) @ 900 RPM

# C.1 Emission Reductions by Segment

112.95 tons/yr 3.68 tons/yr	
<u>Line Haul segment</u> NOx PM	Local Los Angeles/Long Beach/El Segundo segment

17.51 tons/yr	8.25 tons/yr	138.71 tons/yr
0.57 tons/yr	0.27 tons/yr	4.52 tons/yr
NOx PM	<u>Local San Francisco, Richmond, Martinez segment</u> NOx PM	Total Emission Reductions NOx Total Emission Reductions PM

# M/V Klihyam Emission Reduction Summary

# C.2 Emissions Reductions by Air District

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	Line Haul Segment	Local Segment Total	Total	% of All
: : : : :	tons/yr	tons/yr	tons/yr	
SCACIMD	19.06	17.51	36.57	26.36%
VCACPD	10.23		10.23	7.37%
SBAPCD	30.21	0.00	30.21	21.78%
			77.01	
SLOAPCD	13.94	00.00	13.94	10.05%
MBUAPCD	23.24	0.00	23.24	16.75%
BAAQMD	16.27	8.25	24.52	17.68%
PM	112.95	25.77	138.71	
	Line Haul Segment	Local Segment Total	Total	% of All
	tons/yr	tons/yr	tons/yr	
SCAQMD	0.62	0.57	1.19	26.36%
VCACPD	0.33		0.33	7.37%
SBAPCD	0.99		0.99	21.78%
SLOAPCD	0.45	0.00	0.45	10.05%
MBUAPCD	92.0		0.76	16.75%
BAAQMD	0.53	0.27	0.80	17.68%
	3.68	0.84	4.52	

# M/V Klihyam Emission Reduction Summary

# D. Fuel Logs

Fuel, gal	71,000					
11	12/18/2004					
-uel,gal	35,000	48,000	23,500	35,500	142,000	
ш.	1/10/2006	2/6/2006	2/20/2006	3/10/2006		
Fuel, gal	39,100	33,000	30,000		102,100	Fuel, gal
<del></del>	1/14/2005	2/5/2005	3/7/2005			4
õ						02

Fuel, gal	35,010	48,000	35,100	29,000	147,110
ű	4/8/2005	5/8/2005	6/14/2005	6/24/2005	
02					

Fuel, gaí	34,000	38,500	32,000	104,500
Q3	8/5/2005	9/3/2005	9/22/2005	

Fuel, gal	43,000	54,000	38,000	25,032	160,032
04	10/17/2005	11/17/2005	12/14/2005	12/28/2005	

Total 2005 513,742

Vessel began operation on 12-28-04 with 71,000 gallons of fuel onboard which was consumed mostly in Janaury 2005. Use Q1 fuel data for baseline 2005

Adjusted Total fuel consumed in 2005

553,742 gallons

# **Emission Reduction Summary** M/V Klihyam

# E. Trip Logs

E.1. Line Haul Trips

From	To	# trips	Hrs	Avg hrs/trip
Richmond	Los Angeles	17	887	52.2
Long Beach	Richmond	5	322	64.4
Richmond	Long Beach	2	86	49.0
Los Angeles	Richmond	8	400	50.0
El Segundo	Richmond	4	194	
Martinez	Richmond	2	66	
Los Angeles		<b>\</b>	40	40.0
Rodeo	Long Beach	<del>-</del>	50	50.0
Long Beach	Martinez	•	56	56.0
El Segundo	Benecia	. 0	100	50.0
		43	2239	52.1
O		:		İ

One trip on 12/16 115 hrs (weather delayed)

E.2. Local Los Angeles/Long Beach/El Segundo

E.3. Local Richmond, Martinez, Benecia

 Avg hrs/trip	2.6	
Hrs ⊿	212.5	
# trips	83	

2902.5 270 10.8 E.4. Data Reduction
Total run hours for 2005
Total trips for 2005
Avg/trip for 2005, hrs/trip

oei vice	Engine H.P.	Engine H.P. Load Factor Fuel Cons	sumption r	Total hrs	Total hrs   Total Fuel   % of total   Consumed   Fuel   Cal	% of total Fuel
Line hauí	3,800	0.97	201.4	2,239	450,883	81.42%
Local Los Angeles/El Segundo/Long Beach	2,925	0.75	155.0	451	69,916	12.63%
Local Richmond/Benecia/Martinez	2,925	0.75	155.0	213	32,943	5.95%

# ATTACHMENT B M/V KLIHYAM TRIP LOGS

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Tug: KLIHYAM TOWING Barge SUNSET BAY Start 13/18/04

Tug KLIHYAM towing barge SUNSET BAY

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Tug KLIHYAM towing barge SUNSET BAY

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Tug KLIHYAM towing barge SUNSET BAY

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	ANCHARAFE G-2	1850	1.6/27	LONG BEACH	76	2035	6/27
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TONE BEALT	ANK# 8-10	009]	8/2	LOS ANGELIES	1403 8342P	1820	8/1
	403	0655	7/9	Lang Bench	hindle B-5	0830	7/9
\ <u>\</u>	ANCH B-S	0200	7/15	LOS ANGELIES	163	0330	2/15
	1 4 "	1.635	2//5	LOS AMBELES	403 BUNKER	1815	•
8	403	0135	21/16	SAN FRANCESCO	<b>.</b> .	1745	~J~
0	Avice #S	1730	7//18	RICHMOND	L/W #2	815	8///
	J/W #2	0800	7/20	SAN FRANKISCO	ANC# #O	_	1/29
1,00 A	ひか おついか	0235	12/21	SAN FRANLISCO	ANCH #9 LEHELPER	_	7/21
   q	4NC# #9	1840	12/6	RICHMOND	L/W #3		17/7
-	1/2 #S	0655	7/23	RODED	CONOCO PARUTIPS		1/23
	Carloco Prouters	2045	7/23	LONG BEACH	ANCH B-3	2300	2/22

Tug KLIHYAM towing barge SUNSET BAY

Sheet1

Mach 6-3   1100   1726   EL SEGUNDO   # 3   189   18					Arrival Part	Berth	Secured Time	Sec. Date
April 6-3   2210   7/16   CL SEGNIVO   189	Port Departed		Time	Date.		**	0830	7/27
100	LONG BEACH		22 0	1/126	EL SEGUNDO		1020	7/28
189   2210   7/29   Lan'L GEACH   PUCH   19-4-1	EL SEGUNDO	#3	0830	7/28	Los ANGELES	2	0000	00/2
Anch 6.7   1405 8/1   Log Anceles   163	I NE BAILEI KS	68/	2210	~	しゅべる SCACH	₹.0.7		
ANCH 6-9   1405   8/1   LOS ANGELES   163     ANCH 6-9   1405   8/2   EL SEGUNOD   #3     ANCH 6-2   1/35   8/4   LOS ANGELES   163     ANCH 6-2   1/35   8/4   LOS ANGELES   189     189   1410   8/6   RICHMOND   IMPT     SHORE   1800   8/10   RICHMOND   SHORE     SHORE   2240   8/10   RICHMOND   LANTT     CA			2725	7/31	Lang BEACH	ANCH B-9 SHIP		18.77
Color   Colo	13500 SA07		1405	1/8	100 ANGELES	<u>6</u> 3	1600	1/8
ES # 3 0110 8/3 Lavis Beach Anit B-2  Anit G-2 1135 8/4 Los Aniteles 163  ES 189 1410 8/10 Los Aniteles 1899  ES 1899 1410 8/10 RICHMAND THAT  SHORE 1800 8/10 RICHMAND CANIT CANIT CANIT OTHOR 8/10 RICHMAND THAT  COA 2220 8/11 RICHMAND THAT  COA 2220 8/11 RICHMAND THAT  COA 2220 8/12 SAN FRANCESCO ANIT # S  ESCO ANIT OTHO 8/12 SAN FRANCESCO ANIT # S  LANTT OTHOR 8/10 Long Beach # 3  ELS ZHOGE 1800 8/14 RICHMAND THAT  COA 3220 8/17 EL SECUNDO # 3  ELS ZHOGE 1800 8/17 EL SECUNDO # 3  ELS SHORE 8/17 EL SECUNDO # 3  ELS SHORE 8/10 LONG BEACH ANCH 6-3  ELS SHORE 8/10 LONG BEACH ANCH 6-3  ELS SHORE 8/17 EL SECUNDO # 3  EL SECUNDO	LONG DEPCH	RACE D'	2000		CONITY ST	40	0060	
Aykh G-2   1/35   8/4   Los Anceles   163	LOS ANGELES	100	35	. # 🥆	LON'S BICACH	Ą,	0060	8/3
## 16-3 2225 8/4 105 ANGELES 189  ES 189 1410 8/6 RICHMOND SHORE  SHORE 1800 8/9 MARTINEZ SHORE  SHORE 1800 8/9 MARTINEZ SHORE  C SHORE 2245 8/10 RICHMOND TMTT  C CAN 2220 8/11 RICHMOND TMTT  C CAN CAN FRANCESCO ANCH # 3  ESC ANCH # 5 1730 8/12 SACHMOND TMTT  C ANCH # 5 1730 8/14 RICHMOND TMTT  LANT 0910 8/12 CACHMOND TMTT  C ANCH 6-2 1115 8/14 RICHMOND TMTT  LANT 0910 8/12 LONGBEACH ANCH 6-3  ES 240 6 1640 8/12 LOS ANGELES 240 6  LANT C 0910 8/12 LONGBEACH ANCH 6-3  H ANCH 6-3 1300 8/23 LONG BEACH ANCH 6-4 SHIP  H ANCH 6-3 1335 8/24 LONG BEACH ANCH 6-5 SHIP  H ANCH 6-3 1335 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-3 1335 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-3 1335 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-5 1835 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-5 1835 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-5 1835 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-5 1835 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-5 1835 8/24 LONG BEACH ANCH 6-5 SHIP  LH ANCH 6-5 1835 8/24 RICHMOND LANGE	EL SEGUNDO	7	7 - 10 -	3 8	I OC ANTAKIES	163	1305	h/8
189	LONG BEACH	釥	(133	0/1	I OC ANT FIRE	681	08.90	8/5
84   190   8/10   RECHMOND   SHARE   SHORE   1800   8/9   MARTDNEZ   SHORE   SHORE   2245   8/10   RECHMOND   CA	LOS ANGELES	( <u>a</u> )	C777.	1/6	OTCHANGE	HW.F.F	1800	8/8
SHORE 1800 8/9 MARTONEZ SHORE  SHORE 2245 8/10 RTCHMOND 6A  SHORE 22245 8/11 RTCHMOND L/W #3  ANCH #5 1730 8/12 SANFRANCESCO ANCH #5  LMTT 0740 8/12 SANFRANCESCO ANCH #5  LMTT 0740 8/12 SANFRANCESCO ANCH #5  LMTT 0910 8/14 LOS ANGELES 240 B  ANCH 6-2 1625 8/19 LONG BEACH ANCH 6-3  ANCH 6-3 0200 8/22 LOS ANGELES 189  ANCH 6-3 0200 8/22 LOS ANGELES 189  ANCH 6-3 0200 8/22 LONG BEACH ANCH 6-3  ANCH 6-3 0200 8/24 LONG BEACH ANCH 6-3  ANCH 6-5 1835 8/26 LONG BEACH ANCH 6-5  ANCH 6-6 0630 8/27 RICHMOND VANEB	LOS ANGELES	581	07.7	2/10	OTCHROND	SHARE	0835	6/8
SHORE 1000 8/10 RTCHMOND 6A SHORE 2245 8/10 RTCHMOND TMTT 6A 2220 8/12 SAN FRANCESCO ANCH # S ANCH # S 1730 8/12 RTCHMOND V/W # 3 LMTT 0910 8/14 LOS ANGELES 240 B TMTT 0910 8/14 LOS ANGELES 240 B ANCH 6-2 1625 8/19 LONG BEACH ANCH 6-3 # 3 1625 8/19 LONG BEACH ANCH 6-3 # 3 1625 8/19 LONG BEACH ANCH 6-3 # 3 1625 8/24 LONG BEACH ANCH 6-3 # 3 1625 8/24 LONG BEACH ANCH 6-3 # 3 ANCH 6-3 1335 8/26 LONG BEACH ANCH 6-3 # ANCH 6-3 1335 8/26 LONG BEACH ANCH 6-3 # ANCH 6-5 0630 8/27 RICHMOND VANES	RTCHMOND	- Lwi	\$17.0   000		MADTENIE	SHORE	り、元の	6/8
SHOKE	KTTHMOND	VFORE STORES	2001	à è	OTCH LOND	(o.A.	0205	11/8
COA	MARTINEZ	SHOKE	26-77	70		+ 144	0000	11/8
ANCH #5   1730 8/12   SAMPROND L/W #3  ANCH #5   1730 8/12   RICHMOND L/W #3  LAMTT 0910 8/14   RICHMOND TMTT  2406   1640 8/14   LOS ANGELES 240 B  ANCH 6-2   1115 8/17   EL SECUNDO #3  ANCH 6-2   1625 8/19   LONG BEACH   NACH 6-3  ANCH 6-3   330 8/23   LOS ANGELES   189  ANCH 6-3   335 8/26   LONG BEACH   ANCH 6-3  ANCH 6-5   0630 8/27   RICHMOND   NANCE	PETCHMOND	40	2220	S)	KICHMOND	14 :: 3 :	7690	0110
ANCH #5   730 8/12 RICHMOND LIW #3  LM #3 0025 8/14 RICHMOND INTT  LM #3 0025 8/14 LOS ANGELES 240 B  Z40B 1640 8/16 LONG BEACH ANCH B-2  ANCH B-2 1625 8/17 EL SECUNDO #3  #3 1625 8/17 EL SECUNDO #3  ANCH B-3 0200 8/22 LOS ANGELES 189  ANCH B-3 0205 8/22 LONG BEACH ANCH B-9 SHIPP  ANCH B-3 0035 8/26 LONG BEACH ANCH B-5 SHIPP  ANCH B-3 1835 8/26 LONG BEACH ANCH B-6 SHIPP  ANCH B-3 0630 8/27 RICHMOND LANGE	Oron Mowin	TIMIT	0440	\ \ \ \ \	CAN FRANCTSCC	25 TO 1	2020	:ا:
LM # 3			1730	/8	RICHMOND	UW. #3	018/	-
HADAND   TAYTT	101 - 10 - 10 - 10 - 10 - 10 - 10 - 10		V 200	<del> </del>	RICHMOND	THAT	0155	8/i4
HMOND HMOND HMOND ANICELES 240B 1640 8/16 LONGBEACH NOCH B-3 SECUNDO #3 SECUNDO #3 SECUNDO #3 SECUNDO #3 I625 8/19 LONGBEACH NOCH B-3 SECUNDO 8/22 LOS ANICELES 189 SACH ANICH B-3 1835 8/24 LONGBEACH ANICH B-3 1835 8/24 LONGBEACH ANICH B-3 1835 8/27 RICHMOND NANEBE	KECHMOND	7 4 3	2 2 2 2 2	711 8	LOS ANGELES	2408	024S	9//8
ANGELES 2700   115 8/17 EL SECUNDO #3  SECUNDO #3   1625 8/19 LONE BEACH MYCH B-3  SECUNDO #3   1625 8/19 LONE BEACH MYCH B-9 SHIPP  ANGELES   189   1300 8/22 LONG BEACH ANCH B-9 SHIPP  BEACH ANCH B-9 0035 8/24 LONG BEACH ANCH B-5 SHIPP  S BEACH ANCH B-3   1835 8/26 LONG BEACH ANCH D-6 SHIPP  S BEACH ANCH B-3   1835 8/27 RICHMOND WANEB	RICHMONTS	40.00	272	J*	LONG BEACH	Ø	008	91/8
SECUNDO #3   1625 8/19 LONE BEACH PACK B-3  SECUNDO #3   1625 8/19 LONE BEACH PACK B-9  SECUNDO #3   189   1300 8/23 LONE BEACH PACK B-9 SHIPP  ANGELES   189   1300 8/23 LONE BEACH PACK B-9 SHIPP  S BEACH ANGH B-9   0035 8/24 LONE BEACH PACK B-3 C C  S BEACH ANGH B-3   1835 8/26 LONE BEACH PACK B-1 SHIPP  S BEACH PACK B-3   1835 8/27 RICHMOND WANEB	LOS ANGELES	0.057		. I	EL SERVINDO	1	0210	8//8
SECUNDO # 3 10-3 0/11 105 ANGELES 189  BEACH ANCH B-3 0200 8/23 LONG BEACH ANCH B-9 SHEP  BEACH ANCH B-9 0035 8/24 LONG BEACH ANCH B-6 SHEP  BEACH ANCH B-3 1835 8/26 LONG BEACH ANCH D-6 SHEP  BEACH ANCH B-3 1835 8/26 LONG BEACH ANCH D-6 SHEP  BEACH ANCH B-3 1835 8/27 RICHMOND WANEB	LONG BOKE	A C ましょ	200	J~	Love Reach	PACK 6-3	2005	61/8
S 189 1300 8/23 LONG BEACH ANCH B-9 SHEPT ANCH B-9 SHEPT ANCH B-9 0035 8/24 LONG BEACH ANCH D-6 SHEPT ANCH B-3 1835 8/26 LONG BEACH ANCH D-6 SHEPT ANCH D-6	EL SEGUNDO		2000		108 AN/AK 169	681	00400	8/22
S 184 0035 8/24 LONG BEACH ANCH B-3 OF ANCH B-3 1835 8/26 LONG BEACH ANCH D-6 STATE ANCH D-6 STATE ANCH D-6 STATE RECHMOND WANKEB	Lang BEACH		202		Last SFACE		5181	8/23
ANCH 6-3 1835 8/26 LONG BEACH ANCH D-6 SHIP	LOS ANGELES	184	360	à	4		0100	H7/8
ANCH D-6 1535 0/ 26 LOW STATE WALK D-6 1630 8/27 RICHMOND WAY	LONG BEACH	. 1	1000 P	30	+	-	F 1635	8/26
ANCH D-6 0630 0/21 KICHMENT	Caric BEACH	- 1	1335	07/0	╀	1 4	1210	8/29
	LONG BEACH	ANCH DE	0630	0/7.7	$\dashv$	7		ı

Sheet1

Tug KLIHYAM towing barge SUNSET BAY

		46	Date	Arrival Port	Berth	Secured Time	Sec. Date
Coroni April	1/A A (F. C.	2210	Pc/8	MARTINEZ	KANEB/SHORE	0220	8/30
230257	I Charles	1200	8/30	SAN FRANKESCO	ANCE # S	1500	8/30
いていること	14 th 14 th	シュー	- l . '	RTEHMOND	1 i	1870	8/30
NA PROPERTY	1111	2000		RECHMOND	1/m #2	5510	8/3(
KICHWON!	# 1	10.50	ノン	I MY SEMELY	ARCH B-3	0400	9/3
UNITED TO	12 C. C.	1245		LOS ANTELES	189	1420	9/3
TOWER DESIGNATION OF THE PARTY	0 0 0 0	SHIO	9/5	Lows Gerett	76	0335	9/5
LOS INVESTES	12/2	0150	9/16	PICHMOND	KANEB	0955	8/6
STURYOUT	KANTEG	2050	8/6	(Sech Man)	L/W#2	22/0	8/8
Orott May D	1/1/# #9	1340	01/6	LOS ANGELES	189	1225	9/12
1 05 Arther 62	189	1815	9/13	LOS ANGELIES	163	1915	9/13
LOC ANEELES	16.2	2080	4/14	PETCH MOND	U/W#2	0750	9/16
OTCHWOMP	1/2 # 0	2000	9/16	RECHMOND	TMTT	2135	9/16
Separate Separate	ナンベナ	07.77	4/14	RICHMOND	L/W #2	1305	9/17
Organia Salah	ユニボ	0010	81/6	LOS ANGELES	163	.0425	02/6
A VALETON	アルニー	1988	9/20	Lave BEACH	ANCH 8-2	1905	9/20
Catalogue Con	(A-9)	30.00	9/21	LOS ANTIELES	189	2030	9/21
1000 DEACH	190	200	9	LOS ANTELIES	238	2235	9/22
LOS ANCES	238	1200	<u> </u>	EL SEGUNDO	#3	1630	9/23
FI SECION	#30	0230	6	LOWS BEACH	RNCH B-3	1005	1
1 2. Report	A.tru 8-3	1420	9/25	LOS ANTGELES	163	1645	4/25
LONG DOTAL	771	0505	9/26	-	11 L	040	1
100 F 1011		1000	σ	+	KANEB	0125	6776
いいいましている	KANER	2 H S	0	-	TOMIT	2330	$\searrow$
のではあるがら	TWL	0225	6	RECHMOND	42 #2	0355	19/30
RTCHWON!	2 # M2	0420	0/0	SAN FRANKLISCO	ANCE #S	0420	10/1
× = 1-1-4-0					,		

Tug KLIHYAM towing barge SUNSET BAY

Sheet1

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Sec. Date	7/01	5/01	9/01	L/01	8/01	11/01	11/01	10/13	10/13	9//0/	81/01	61/01	10/21	10/22	10/25	10/27	10/29	10/30	10/31						
Secured Time	07:01	0220	00% O	S850	SOLI	1625	2215	050/	0060	2225	0730	2007	030	0730	5770	0860	0655	0835	1210				٠		
Berti	4 m #2	163	<b>₩</b> 3	189	年3	IMTT	KAMEB/PAC-ATL	S# HJVY	5 # M/7	<del> </del>   89	ANCH B-4	LL	ANCH B-3	84	189	#3	CETY DOCK	VALERO	VW#3			,			
Arrival Port	RICHMOND	LOS ANGELES	EL SEGIMBO	LOS ANGLEES	EL SEGUNDO	RICHMAND	RICHMOND	SAN FRANCESCO	RICHMOND	LOS ANGELES	Lovis BEACH	Laws Beach	Lange Beach	EL SECUNIDO	Los Ancelles	EL SEGUNDO	BENICIA	BENTEIA	RICHMOND	•	•				
Date	10/2	[0/3	10/6	ا ما/زها	10/8	10/9	10/11	10/12	10/13	10/14	81/01	10/19	10/21	10/21	10/24	10/26	10/27	10/30	10/31					,	
Time	2445	0255	0310	2015	l oll	1725	2100	0955	0800	1550	0605	0061	0225	2200	0461	0030	0330	0710	0060						
Berth	ANCH #5	1/w #2	163	#3	681	<b>#</b> 3	T-WIT	KANEB/PAC-XITC	ANCH # 5	1/W#3	681	ANCH B-4	LL	April 8-3	#3	189	#3	CITY DOCK	VALERO					÷	
Port Departed	SAN FRANKISCO	RICHMOND	LOS ANGECLES	EL SEGUNDO	LOS ANGELES	EL SEGUADO	RICHMOND	RICHMOND	SAN FRANKISCO	RICHMOND	Los Anteres	Long Beach	Lands BEACH	LON'S BEACH	EL SECLUADO	LOS ANGELES	EL SECUMBO	BENICIA	BENTEIA						

Page C

# Towage Summary From 122864 To CASTING

SAUSE BROS.
155 E. Market Ave. \* Coos Bay, OR. 96717 \* Phone: (541) 269-5841 \* Fax: (541) 267-8245

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Notes	,													and the second s										The state of the s	Anna de la companya d					
Transit	52.6 hrs	8.3 hrs	8.2 hrs	5.9 hrs	47.0 hrs	0.9 hrs	Lohrs	78.6 hrs	t i	1,1 hrs.		9.5 hrs	6.8 fres	7.0 hrs	51.0 kms	1.4 hts	3.2 hrs	49,3 lvs	4.6 hrs	7.2275	9,5108	48.8 hrs	1.2 hrs	5.7 hrs	\$1,0,12	4.8 hrs	7.1 hrs	41.3188S	47,9 tms	11.3 hts
Antival An Bath	163	188		ikkiii	Fig	ANCHORAGE 5	LONGWHARF	<b>88</b> 1	NO 2 ANCHO!	5	SOD IRAVO3 AIN		188		מנוג ממכא	WAERO	Heren	189	3:25 TRAVOZANCHOP	With the state of		CITY BOCK	SHELL	LONGWITCH	189		282	LONGWHARF		
Antival	P. 7.30	100	\$300	17.03	16:25	10:50	8:00	22.25	8:00 IR	2007	# 00%	7.30	523	7:30	6,50	8:35		£2	3.25	3,92	7:30	0.35	1210	13:45	18.45 54.55	1500	40,00	0270	18:30	202
Date Are	Torgens	Medicina	+CREK6	10408705	2011/03	10/12/05	10/13/05	10/17/05	10M8/05	10/19/05	1627.86	10722015	10/25/05	10/25/05	10/29/05	10/30/05		11,04,06	11KEKS	1406705	11/08/05	11/1/105	11/12/05	11/13/05	11/16/05	11/17/05	11/16/05	11721ATS	11/23/05	11/25/05
Deporture	2:65	20:15		. TO	17.25	<del>8</del> 88	800	16,50	6.20	19:00	273	22.60	19040	8.30	3720	7,10		90,05	22:50	25	22.50	\$ 13	8	8:00	18:45	10:10	258	7:00	19:36	19.46
Out Date 1	10/03/05	10/06/05	10/06/05	10/08/05	1C/UB/US	10m2	1,1905	10114KS	10/18/05	10/18/05	10/21/06	10/21/05	10/24/05	10/26/05	10/27/05	10/20/05		11102/05	11,05/05	11/05/05	11/07/06	11,08/05	11/12/05	11/13/06	111466	11/17/05	11/18/05	11/19/05	11/21/05	1125,05
Dep Bert	LONGWHAME		1633	\$89		SHORE	ANCHORAGES	LONGWHARE	188	82 4 2410R	12	EL SEGUNDO BRAVOS ANCHOR 10/21/05		***************************************		CITY DOCK		LONGWHARF		58	BRAVO 2 ANCHOR 11/07/06		CITY BOOK	TIPHS	LONGWHARF	189		[63	LONGWHARF	189
ę.	LOS ANGELES	LOS ANGELES	R SEGUNDO	EL SEGUNDO	RCHMOND	RICHIMOND	RICHMEND	LOS ANGELES	LONG BEACH	LONG BEACH	ONG BEACH		LOS ANGELES	EL SECUINDO	BENICA	BONCK		LOS ANGELES	LONG BEACH	E SEGUNDO	EL SEGUNDO	BENICIA	MARTINEZ	RICHMOND	LOS ANGELES	E SECUNDO	LOS ANGELES	RICHROMD	LA 189	CUNINDS 18
From	RICHAIOND	EL SECUNDO	OS ANGELES	DOS ANGELES	S SEGUNDO	RICHARONO	RICHWOND	AICH DIND	LOS ANGRES	LONGBEACH	LONG BEACH	LONG BEACH	E SEGUNDO	LA 189	EL SEGUNDO	BENICIA	***************************************	RICHMOND	E. SEGUNDO	LCS ANGELES	LONG BEACH	EL SECUNDO	BONCA	MARTINEZ	RICHMONO	LOS ANGELES	E SEGUNDO	LOS AMGELES	HICHWOND	SE SOIDE BO
Master	MES	MILE	Annes	MILES		MES	MES	MRES	SALES	MILES	MLES	MIES	MILES	MLES	MLES	MLES	***	MLES	Sanw	MLES	MILES	MILES	MLES	MILES	MILES	MALES.	MILES	MILES	MILES	10 66
Burge 1 Barge 2	S SUNSET 8	SE SUNSET B	Se SUNSET B	Se SUNSET B	56 SUNSET B	97 SUNSET 8	8 135M18 75	57 SUNSET B	ST SUNSET	S7 SUNSET	57 SUNSET B	ST SUNSE B	67 SUNSET B	67 SUNSET 8	ST SUMSET B	ST SUNSET 8		S7 SUNSET B	57 SUNSET 8	57 SUNSET 8	57 SUNSET 6	57 SUNSET B	57 SURKET B	ST SUNSET 8	ST SUNSET B	SY SUNSET B	S7 SUNSET 8	57 SUNSET 8	S7 SUMSET B	A CHARTER

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Towage Summary From 1228/04 To 0331/08

SAUSE BROS.

155 E. Market Ave.\* Caos Bey, OR 96717 \* Phone: (541) 269-5841\* Fax: (541) 267-8245

	A STATE OF THE STA									THE PROPERTY OF THE PROPERTY O	The state of the s																	٠		
Notes												3						•												
Transit	45.1 hrs	1.4 hrs	54.0 hrs	d.a hrs	6.3 fers	4.5 hrs	1.5 hrs	115.2 hrs	65.4 hrs	48,7 hrs	57.5 hts	1,4 Nrs	68.5 hrs	1,5 lars	14.7 Ms	B.3 hrs	1.4 hrs	59.4 hm	23fms	1.8 hrs	50.9 hrs	1,5 hrs	5.8 hrs	46.B hm	L4 hrs	D.8 hrs	1.4 hrs	3.0 hrs	t.a hrs	S0.8 fz:
Arrival Arr Berth		LONGWHARF	189	ANCHOR	SAUSE		169	lanwherf	<u>8</u>	tongather	<b>3</b> 2	<b>3</b>	LONGWHARF	163		187	ANCHORAGE	LONGWHARF	shore	longwiren	250	189		Ш	anchorage 5	longwherd	ANCHORAGE	TIM	LONGWHARG	183
Arrivas	22	18:20	88	11:00	8	\$3	425	22-35	88	12:10	1,00	\$23	16:15.	51:15	2,00	25.4	505	15.30	2:15	6.50	2.15	13; EG	\$5045	14:3D	0.15	7.05	20:15	17-20	605	1:25
Date Arr	11,729/05	9035241	12/05/05	12/06/05	12/08/05	12/07/05	12MERCS	1220/05	12/25/05	12/28/05	01/01/06	01,02,00	ONICETE	9111108	01112/06	01/13/06	01/14/06	0177708	61718ADB	01/20/08	0112406	01/24/08	0172506	01Z8036	612206	01/23/106	01/30/06	01/31/06	0.2001,106	SOPRIES
Departme	9.15	14:56	14.20	M215	22.00	2:00	11:10	3:20	10,06.	11:30	15:30	3:00	19:45	9:45	P& 15	6:05	3:40	4:05	5:00	5.00	13.20	4.25	10,00	13:45	22.50	6:45	05:23	14.30	7,00	22.35
Brp Cats	11/27/05	11/29/05	120305	12/08/05	12/07/05	1220705	12/15/05	12/16/05	12/22/06	1225605	13/29/05	CHECEDE	01/02/08	01/11/06	01/11/QB	017370	OTIVADE	OH/15/06	Otrrevos	901/20106	OTIZIADE	01174/08	OUZSOE	CHIZENDE	01/28/06	01/28/06	01/30/08	9015110	CONTRO	SON CONTROL
Dep Berk		. LING	LONGWHARE	189		ANCHOR	SAUSE	\$23	longhwart	163	LONGWHARF	165	53	1469	163		187	ancharage 5	Kraysted	encris	tong-whari	163	189		2010	andonege 5	LONGWHARF	ANCHORAGE 5	imt	longwhart
ê,	RICHMOND	RICHIMONO	LOS ANGELES	LCS ANGELES	LONG BEACH	A. SEGUNDO	LONG BEACH	RICHMOND	LOS ANGELES	RICHAROND	LOS ANGELES	LONG BEACH	RICHMOND	LOS ANGELES	E SEGINDO	LCS ANGELES	LONGBEACH	RICHROND	KARTINEZ	RICHMOND	LOS ANGELES	LOS ANGELES	eł segundo	RICHEROND	RICHMOND	RICHRIGND	RUCHANCIND	RICHMOND	RICHINOND	LOS ANGELES
read.	EL SEGUINDO	RICHMOND	RICHMOND	LOS ANGELES	EL SEGUNDO	CONGBEACH	LONG BEACH	LONG BEACH	RICHIMOND	LOS ANGELES	RICHINGIND	LOS ANGELES	LONG BEACH	LOS ANGELES	LOS ANGELES	EL SEGUNDO	S3 BEOWN S57	LONGBEACH	RICHMOND	MAKTINEZ	RCHNOND	LOS AWGELES	LOS ANGELES	B SEGUNDO	RICHMOND	RICHAROND	RICHMOND	RICHMOND	RICHBIOND	RICHAROND
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Page 22 of 37

# SAUSE BROS.

155 E. Market Ave.\* Coos Bay, OR 96717 \* Phone: (541) 269-5841\* Fax: (541) 267-8245

From 122864 To 03/31/06

Towage Summary

	Starge 3	Barye 2	Marie	Freez	€	Dep Berr	Dep Bure	Department	Date Ar	Anthol	Arrived Are Burth	Transtt	Notes
**	61 SUNSET BA		LWDKGSTONE	LONGBEACH	EL SEGUNDO	EL SEGUNDO BRAVO 3 ANCHOR COZENTO	CO728106	80.02	OJZBADB	13.00	CHEVRON	3.0 fyrs	Gerage dept caso na to PDX to LA - depts caso PDX to LA
	61 SUNSET BA		AGNER.	LONGBEACH	EL SEGUNDO	EL SEGUNDO BRAVO 3 ANCHOR COZENG	CCVZ&/OG	10:00	C3/29/U6	13800	CHEVRON	3.0 hrs	George dept Oktil NB to PDX to LA - depts 0850 PDX to LA
	61 SUNSET BA		LIVINGSTONE	EL SEGUINDO	LOS ANGELES	CHEVRON	03/29/08	00.0	USTERVIE	14:10	691	8.0 hrs	George dept 0800 NB to POX to LA - depts 0950 PDX to LA
	61 SUNSET BA		MINER	EL SEGUNDO LOS ANG	LOS ANGELES	CHEVRON	03/29/08	9009	305230	14:00	163	8.0 tres	George dept 0900 MB to POX to LA - depts 0950 POX to LA
	61 SUNSET BA	•	LIVINGSTONE	LCS ANGELES LOS ANG	LOS ANGELES	163	90/02/60	2,00	90,0250	8-00	169	1.0 bars	George dept, 0800 MB to PDX to LA-depts 0850 FDX to LA
	OI SUNSET BA		MINEA	LOS ANGELES	LOS ANGELES	791	9070000	872	03/30/06	8:00	683	1.0 hrs	George dept (1900 NB to PDX to LA- depts (2850 PDX to LA
	SINSET BA		LIVINGSTONE	LOS ANGELES	LONIGBEACH	189	30/12/200	B:00	03/31/06	8 33 8	AMCH B3	3.5 hrs	George dapt, GBUO NB to POX to LA . depts 0950 PUX to LA
	51 SUNSET BA		MRER	LOS ANGELES	LONG BEACH	16.9	CG-21/05	003	93/15/60	9236	ANCH B3	3,5173	George dept. 0600 NB to PDX to LA. depts. 0850 PDX to LA.
	PAPH INTH SALBUMOL	TYTHE 2	HAINA										Y
	50 HANA		RICKEY	LONGWEW	HONOLUL	WENCO	01/18/06	12.45	CCACCAGE	10:00	10:00 BARGE HARBOR	12	
	60 COLUMBIA		FIG.	BENECIA	MARTINEZ	CITY COCK	02/16/05	13.55	42748/DB	14:40	SHELL	8760,8 hrs	

			The state of the s												V		Actorist department of the contract of the con
	429.2 hrs	8760,8 hrs	33.1 hrs	254.6 fus	123.2 hr		1955 hrs	14.3 trs	143.2 hrs	1300 hrs	14.8 hrs	18.0 turs	4.0 lus	G.6 hrs	184 hs	14.5 hrs	27.7 kms
	10:00 BARGE HARBOR 4292 hrs	SHOL	PORTDOCK	23:59 200S BAY DOCK 254.6 lus	ZATHST.B-11	8-122	CAPE ARAGO										
	10:00	14:40	21:00	23:59	20:00	000	3.7. S. 7.	438	19:00	21.90	14:50	8:00	1	187	25.55	1230	20:35
	(CONTENES	CZHB/DB	05,06,05	05/18/05	05/24/05	0.5728/05	06/04/05	10403405	1071205	10724705	1072505	10,27,05	11/08/05	1 NOEMOS		11/18/05	11/24/05
	12.45	13.50	99	E,	16.50	24:00	80.58	<del>4</del> 8	14:48	11.00	500	(4:00	800	21:00	330	29:00	1835
	01/18/06	02/16/05	188	05:09:45	0.6719,05	CEZETO	CSZAMS	10/02/05	10,06,05	10/19/05	10/25/05	10/28/05	11/03/05	11/06/05	1 Metros	147506	112305
	MENCO	CITY COCK	BAGRE HAREOR	PORT DOP	CAPE	2,5H ST. 8-11	B-122			Andreas de la companya del la companya de la compan				•			
	HONOLUL	MARTINEZ	FED	COGS BAY	SAN DIEGO	LONG REACH	CCCSBAY	SANDIEGO	COOS BAY	HOMBBECH	SAN P SGO	LOW BEACH	STORIA	BEHOLEEN	SANDIEGO	LONG BEACH	ASTORIA
	LONGWEYF	95MC14	HCANDLUKU	O]H	CDOS BAY	SAN DIEGO	LONG BEACH	LONG BEACH	LONGBEACH	COOS BAY	ONG BEACH	CSSIN ENECO	MENEW	AL CORIA	LONG	SAN DIEGO	COOS BAY
PAPH ININ STI SUMOI	RICKEY	נסנו	3	CASSEE	BRESSINCK	BRESSINCK	BRESSIMOK	נסת	छ ५५ एम	ि श ध्या	נסח	TOI	TTO	Fig	דיסן	1107	ET HALEWA NEHALEM SI LOTT
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II Sumor	SO HANA	SO COLUMBIA	SO HANA	SO HAMA	SO NEHALEM	50 NEIVALEM	SO NEHALEN	SI NEHALEM	S1 NEHALEM	SI NEHALEN HANALEI	ST HANALES	SI HANALE	MITY	SI HANAEI	ST NEHALEM	SI NEFALEN	ST HALESWA

Thursday, April 13, 1006

# Towage Summary

From 1228/04 To 03/31/06

155 E. Market Ave.\* Coos Bay, OR 96717 \* Phone: (541) 269-5841\* Fax: (541) 267-8245

SAUSE BROS.

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Notes			www.enderdenimerererunts.com/	A THE TRANSPORT OF THE	demokrapen och man sam sam en dem demokrapen provinska kalandar provinska kalandar demokrapen demokrapen demokr		Volt. 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1			and a special property of the special		inited for the contract of the force of the contract of the co	***************************************	Andrews of the state of the sta		**************************************	efferereren envelen mikki ladadada kundu mikki intakadada kundu en ekitir intakadada kundu filmada		bekennne eillitt <b>illisk fra</b> ncessississe kooste esteriser	MONTH CHARLES AND	A CONTRACTOR OF THE PROPERTY O		orden dak programmen sampling dak den somerrefilling dak demogrammen granden errenden errenden errenden errend	AND THE PROPERTY OF THE PROPER		and the second s		anderston the second		First & Friend Springers and Company of the Company
Trumst	1.5 1/45	10.3 tms	47.0 hrs	49.6 hrs	O.S. furs	1.0 hrs	1.3 hrs	8.8 firs	4.3 Eres	1,7 105	7.7 hrs	23.0 hrs	48 2 fars	3.5 (93	1.8 hrs	3.5 tirs	44414	51.5 hrs	1.0 hrs	2.4 hrs	60.2 hrs	1.0 hrs	6.3 hrs	1,4 hz	3.2 t.rs	S& O Ins	6.3 hrs	5.4 hrs	0.8 hrs	- 1.8 hrs
Arrivel Arr Berth	18:3		CONCINTARE	153	3	39.	₽		anchorage 3	381		Congerrant	169		ESO SRAVO 3 ANCHOR	163	LONGWHARF	163	188	B 11 ANCHOR	1841	CASTIROL.	SHORE	SEU ANCHORAGE 22	17:15 LONGWHARF B2	189	CHEMON	188	163	21:30 AVO 3 ABACHORA 1.8 hrs
Arrivel	7:30	8:15	0:15	23:40	11.45	27:45	22.15	8.45	11:35	8	14:40 6	10.15	9:15	13,00	0539	3	27.75	4:45	18:30	22:25	1.45	18:45	953	250	17:15	20:30	16:18	17,28	11:00	21.30
Redr. Arr	90/90/20	02/07/06	02/10/06	02/14/06	02/15/06	02715/06	02/16/06	CZYEKE	COMPATE	0272006	90/12/20	02/24/05	03/02/08	90/60/60	SOLEDED	CAUCATE	CCADE/DE	90/04/80	CONTOR	03/11/05	035/15/06	9031150	03/17/06	0371 EXTE	COMPLEE	002200	90/62/60	60724/05	02/25/06	30/2Z/00
Departmen	0388	2240	1:15	22:06	30,11	20:45	21:00	22500	250	238	982	11:15	90.6	9:30	9:00	6:15	1:15	5577	67.00	28:00	13:30	18:45	22:30	3:38	14:00	1230	10:00	12.00	10c15	\$\$ \$2 \$#
Dep Date	CONTEND	CZIOSIOS	90/80/20	0212/06	02/15/06	90/51/20	02/16/06	02/17/06	90/51/20	02/20/06	eazhX6	C2723/US	02/28/06	CONDUCTOR OF	SOURCED	03/04/06	SOUSONS	CSYCHYCE	CIS/No/CIDS	00371506	CONZUE	CONTSYDE.	SC/BIVED	DAMENDE	C3/19/06	OZZZINDE	03/23/08	0372406	Carzaide	03/25/06
Dep Bert	189	163	**************************************	CONCENTERE	153	163	169	41		anch b3	189		ANCHORAGE 5	EL SEGUNDO BRAYO 3 ANCHOR 030306	189		183	LONGWHARF	183	189	B 11 ANCHORAGE (131220)	מעדד	CASTROL	SECRE	ANCHORAGE 22	tongwithsof	168	CHEVRON	189	16.9
A	LOS ANGELES	EL SEGUNDO	RICHIMOND	LOS ANGELES	LOS ANGELES	LOS ANCELES	LONGBEACH	ed suggestion	LONG BEACH	LCS ANGELES	opundas p	RICHEROND	LOS ANGELES	EL SEGUNDO 1	LONG BEACH	LOS ANGELES	RICHMOND	LOS ANGELES	LOS ANGELES	LCANG BEACH	RICHMOND	RICHMOND	MARTINEZ	RICHMOND	RICHMOND	LOS ANGELES	el segunda	LOS ANCELES	LOS ANGELES	LONG BEACH
Progr	LOS ANGELES	LOS ANGELES	EL SEGUNDO	RECHINOND	LOS ANGELES	LOS ANGELES LOS ANGELES	LOS ANGELES	LONG BEACH	opundes le	LONGBEACH	LOS ANGELES	el segundo	RICHBACKO	LONGBEACH	LOS ANGELES	ET SEGUNDO	LOS ANGELES	RICHMOND	LOS ANGELES	LOS ANGELES	LONGBEACH	RICHIMONO	RICHARDND	MARTINEZ	RICHMOND	RICHAROND	LOS ANGELES	opundes le	LOS ANGELES	LOS ANGELES
Pri 200mm	MES	MES	MLES	MILES	MIES	MES	Salles	MLES	MILES	MLES	MRES	MES	MILES	MILES	MLES	MALES	MES	MLES	ALES	MES	MLES	<b>2</b> ES	PARLES	MES	MILES	MINER	MINER	MNER	MINER	MINER
Z -SUTE	-																													
Berge	e Passos os	BO SUNSET B	80 SUNSET B	60 SUNSET 8	B SUNSET B	61 SUNSET B	61 SUMBET 8	61 SURSET 8	8 L3SMDS 19	en sunseri a	et SUNSET B	81 SUNSET B	. 81 SUNSET 8	61 SUNSET B	er SUNSET B	61 SUNSET B	81 SUNSET B	er SUNSET &	8 L3SNIS IB	81 SUNCET B	el SINSET B	O SUNSEL B	S SINSET 8		81 SUNSET B	61 SUNSET 6	er SUNSET &	61 SUNSET B	61 SUNSET 9	61 SUNSET 8

# ATTACHMENT C ELECTRO-MOTIVE DIESEL EMISSIONS DATA SHEET

06-02-99 10:10 EMD 2ND FLR SALES

WHILEY DETROIT SHI DIESO - 8056-174104 TEL: 1-708-387-5845

HO.SEA FOR Feb 14,92 10:52 No.006 P.Q

EMO ENGINE

### ELECTRO-HOTIVE

LaGrango, Illinois 60526 New Fax Number: 708/387-5845

Location: Sales Dept. - 2nd Floor (West End)

### TELEFAX COMMERICATIONS

DATE: 2/14/92 TIME: 10:30 AM

TO:

Valley Detroit Diesel

FECH: J. W. Sebuck

EMD-Power Products

El Cajon, CA John Wilkin =KTTA

FAI: 619/447-8556

YAX: 708/387-5845

Following this cover page, there will be 1 page(x) transmitted (SEE MESSAGE BELOW). If problems occur in transmission or all pages are not received, please contact us at 708/387-8641. 

SUBJECT: VDDA/Crowley Maritime

Request for Exhaust Emissions

REF: 2/12/92 Fax from Ed Schlucter

In accordance with the referenced telefax, the following emissions data shall pertain: (Grass/REP-HR.)

Engino	ME	HOX	_80	_C62_	*S02
20-645R6	3600	12,32	.77	. 42	.82
16-645E5	2875	12.4	. 90	. 29	.72
12-645E5	2150	13.2	-61	. 37	84
8-645E5	1450	12.36	.72	.31	.87
16-645R2	1950	15.2	2.69	,59	.91
12-645E2	1500	16.0	1.20	<b>.40</b>	.90
8-645E2	1050	17.15	2.10	. 40	. 90

<sup>\*</sup> Based upon fuel averaging .25% sulfur

Jeff Sebuck

Power Products Sales

A description of the emissions instrumentation is attached.

# ATTACHMENT D ELECTRO-MOTIVE DIESEL TIER 2 CERTIFICATE OF CONFORMITY

# ELECTRO MOTIVE.

9301 West 55th Street LaGrange, IL 60525 USA

Tel: 708.387.5884 Mobile: 708.710.1490

Fax: 708.387.5845 robert.e.spicer@emdiesels.com

# US EPA ISSUES MARINE TIER 2 CERTIFICATE OF CONFORMITY applicable to

## EMD SERIES 710G7C-T2 ENGINE FAMILY

Electro-Motive Diesel, Inc. (EMD) is pleased to announce the United States Environmental Protection Agency (US EPA) has issued a 2006 Model Year Tier 2 emissions Certificate of Conformity to EMD for our Series 710G7C-T2 family of diesel marine engines in accordance with the standards of 40 CFR 94.

The US EPA Marine Tier 2 Certificate of Conformity applies to

EMD Series 710G7C-T2 Engine Family, including:

8-cylinder	2000 BHP	@ 900 RPM
12-cylinder	3000 BHP	@ 900 RPM
16-cylinder	4000 BHP	@ 900 RPM
20-cylinder	5000 BHP	@ 900 RPM

(All rating shown above are Continuous with 10% overload available)

Duty Cycles for the complete 710G7C-T2 Engine Family, including:

0	Table B-1 (IMO E3)	Variable Speed Fixed-Pitch Prop	@900 RPM
0	Table B-2 (IMO E2)	Constant Speed Propulsion	@900 RPM
0	Table B-3 (IMO C1)	Variable Speed Variable-Pitch Prop	@900 RPM
0	Table B-1 (IMO E3)	Variable Speed Fixed-Pitch Prop	@800 RPM

The EMD Series 710G7C-T2 Family of engines meet the not-to-exceed (NTE) zone requirements of 40 CFR 94.8(e) when operated under all conditions which may reasonably be expected to be encountered in normal operation and use.

A copy of the US EPA Certificate of Conformity is enclosed for reference.

Please contact the writer with any questions regarding this subject.

Robert E. Spicer Business Manager Power Products

## UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WASHINGTON, DC 20460

2006 Model Year Certificate of Conformity

Manufacturer:

ELECTRO-MOTIVE DIESEL, INC.

Marine Diesel Engine Family: 6EMDM0710GT2

Certificate Number: THC+NOx FEL:

EMD-MCI-06-04

PM FEL:

N/A N/A

Date Issued:

APR 1 9 2006

Kall J. Simon, Acting Director

Compliance and Innovative Strategies Division

Office of Transportation and Air Quality

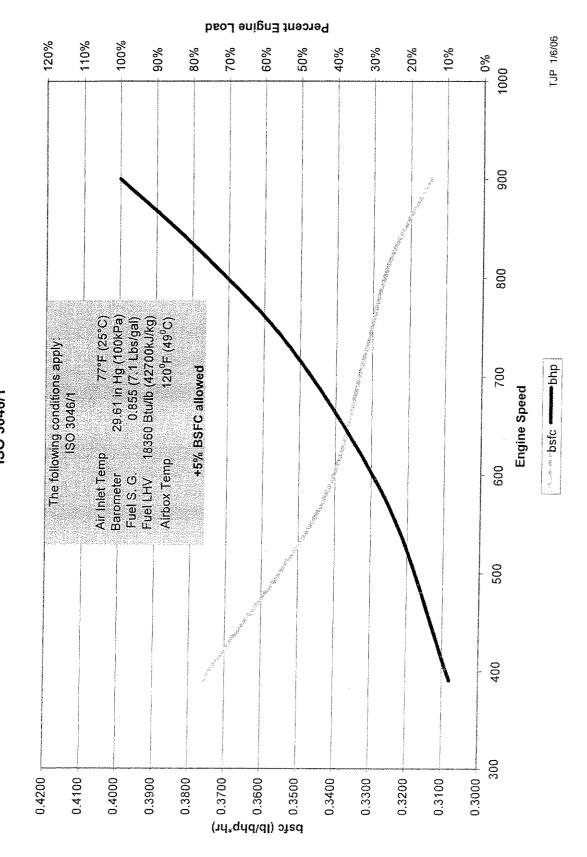
Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR 94, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following marine engines, by engine family, more fully described in the documentation required by 40 CFR Part 94 and produced in the stated model year. This certificate of conformity covers only those new marine compressionignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 94 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 94. This certificate of conformity does not cover marine engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 94.215 and 94.504 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 94. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void ab initio for other reasons specified in 40 CFR Part 94.

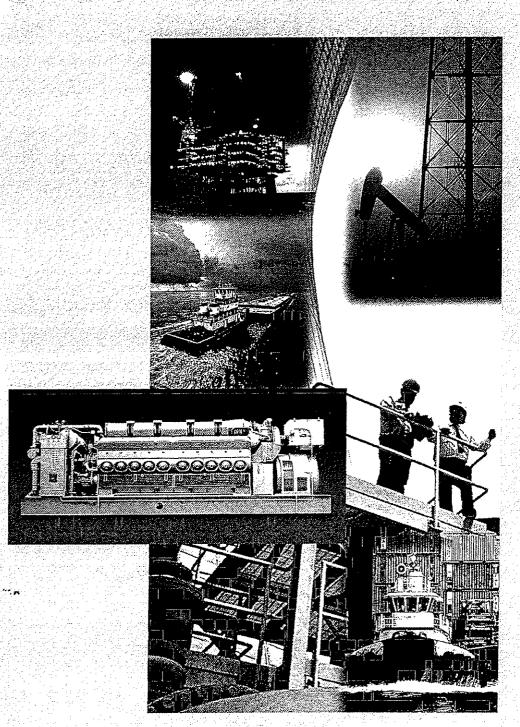
This certificate does not cover marine engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.



8-710G7C-T2 Engine
2000 BHP @ 900 RPM Rating
US EPA Marine Tier 2 Emissions Compliant
Propeller Cube Curve
ISO 3046/1



# ATTACHMENT E ELECTRO-MOTIVE DIESEL 645 AND 710 SERIES DIESEL ENGINE SPECIFICATIONS



- Marine Propulsion
- Electric Generating Plants
- Industrial Power Units
- Offshore Well Drilling
- Power Shovel and Dragline Applications
- Land Drilling Rigs
- Dredging

**EMD** Power Products



# GM/EMD Diesel Engines

# 800-5000 HP Wide Power

**Applications** 

Electro-Motive
Division (EMD) of
General Motors Corp.
produces diesel power
for marine propulsion,
offshore and land based
oil well drilling rigs,
stationary power
generation and railroad
locomotives.

The GM/EMD line of engines is available in 8-, 12- and 16-cylinder roots blown and 8-, 12-, 16- and 20-cylinder turbocharged models. The horsepower ranges from 800 to 5000.

More than half a century of engine design experience has made Electro-Motive a leader in the development of diesel motive power. Electro-Motive is the only diesel engine manufacturer of its size to have produced more than 65,000 engines. This success stems from product reliability, service ability, load acceptance capability, low operating costs and ease of maintenance with standardized components.

# General Data — Common to both 645 and 710 Series Diesel Engines

Type	2 cycle—45° Vee	
Crankcase and oil pan		
construction	Welded steel	
Cylinder air iniet	Ports in cylinder liner	
Exhaust	Four valves in cylinder head	
Piston cooling	Oil-direct pressure stream	
Main bearing lubrication	Full pressure	
Lube oil pumps	Main oil, piston cooling, scavenging engine driven, positive displacement, helical gear type	***************************************
Engine overspeed trip	Centrifugal—Independent of Governor	
Governor	Woodward*	
Fuel supply pump	Positive displacement, engine driven	
Fuel injectors	GM unit injectors—needle valve	
Engine starting	Air motor*	
Engine cooling water pumps	Engine driven—centrifugal	
Crankpin diameter	6 ½ inches (165.10 mm)	
Piston pin diameter	3.68 inches (93.47 mm)	
Rotation facing the flywheel	Counterclockwise*	
Options Available		

## Data Applicable to Specific Engine Series

	645 Series Engines	710 Series Engines
Bore x stroke	9 % x 10 inches (230.19 x 254.00 mm)	9 % x 11 inches (230.19 x 279.40 mm)
Displacement per cylinder	645 cubic inches (10.57 liters)	710 cubic inches (11.64 liters)
Piston speed	1250 ft/min (381 m/min) at 750 rpm 1500 ft/min (457.2 m/min) at 900 rpm	1375 ft/min (419 m/min) at 750 rpm 1650 ft/min (503 m/min) at 900 rpm
Crankshaft main bearing diameter	7 ½ inches (190.5 mm)	8 ½ inches (215.9 mm)

## Data Applicable to Specific Engine Model Numbers

		Roots Blower	
Engine Model	8-645E	12-645E	16-645E
Number of Cylinders	8	12	16
Compression Ratio	18:1	18:1	18:1
BMEP @ 900 RPM (PSI)	90	85	90
Number of Main Bearings	5	7	10
Number of Engine Blowers	1	2	2
Туре	Roots Type-Helical Lobes	Roots Type-Helical Lobes	Roots Type-Helical Lobes
Driven by	Engine Gears	Engine Gears	Engine Gears 1

				Turbac	harged			
Engine Model	8-645FB	12-645FB	16-645FB	20-645FB	8-710GB	12-710GB	16-710GB	20-710GB
Number of Cylinders	8	12	16	20	8	12	16	20
Compression Ratio	16:1	16:1	16:1	16:1	16:1	16:1	16:1	16:1
BMEP @ 900 RPM (PSI)	130	145	145	136	155	155	155	155
Number of Main Bearings	5	7	10	12	5	7	10	12
Number of Turbochargers	1	1	1	1	1	1	1	1
Туре	*	*	*	*	*	*	κ.	
Driven by	+	t	+	+	+	t	+	+ (

<sup>\*</sup>Centritugal Flow

<sup>+</sup>Exhaust Gas and/or Engine Gears Through an Over-Running Clutch

# Marine Propulsion and Generating Units

A complete line of GM/EMD engines is available to meet requirements for marine propulsion and marine generator set applications. A complete power package with engine, reverse-reduction gear or generator and accessories is available through EMD Power Products

Distributors. The propulsion units are

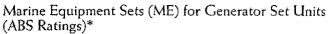
also available without

skid mounting for direct application to the vessel

structure.
Electro-Motive
marine propulsion
drives are also available
with two, three or four
engines driving a common reverse-reduction
gear. A straight-reduction gear is available
when controllable pitch
propellers are required.

Marine Equipment Sets (ME) for Marine Propulsion Units (ABS Ratings)\*

		800 RP	M Ratings	900 RPN	A Ratings
Marine Drive Model No.	Engine Model	Engine BHP	Engine kW	Engine BHP	Engine kW
Roots Blown					
ME8E6	8-645E6	•	-	1050	785
ME12E6	12-645E6		*	1500	1120
ME16E6	16-645E6	*	-	2100	1565
Turbocharged					
ME8F7B	8-645F7B	1525	1137	1700	1265
ME12F7B	12-645F7B	2305	1720	2550	1900
ME16F7B	16-645F7B	3150	2349	3505	2610
ME20F7B	20-645F7B	3600	2685	4000	2985
ME8G7B ·	8-710G7B	1760	1310	2000	1500
ME12G7B	12-710G7B	2625	1960	3000	2240
ME16G7B	16-710G7B	3525	2628	4000	2985
ME20G7B	20-710G7B	4400	3310	5000	3730

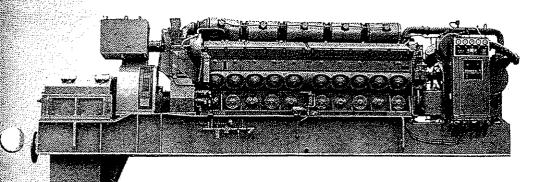


Generator Set Model No.	Engine Model	Continuous Output 60 Hz-900 RPM	Continuous Output 50 Hz-750 RPM
Roots Blown			
ME8E6	8-645E6	745 kW	570 kW
ME12E6	12-645E6	1075 kW	865 kW
ME16E6	16-645E6	1500 kW	1210 kW
Turbocharged			
ME8F7B	8-645F7B	1210 kW	1010 kW
ME12F7B	12-645F7B	1825 kW	1530 kW
ME16F7B	16-645F7B	2500 kW	2100 kW
ME20F7B	20-645F7B	2865 kW	2580 kW
ME8G7B	8-710G7B	1440 kW	1200 kW
ME12G7B	12-710G7B	2150 kW	1790 kW
ME16G7B	16-710G7B	2865 kW	2385 kW
ME20G7B	20-710G7B	3580 kW	2980 kW

Subbase, controls and customized final assembly furnished by EMD authorized Power Products Distributors worldwide.







# DATA SHEET M/V KLIHYAM O.N. 1084928 3900 HP TWIN SCREW TUG WITH FIXED NOZZLES AND QUAD RUDDERS

The vessel is a double chine, welded steel, twin screw tugboat. The vessel has seven transverse air tight and water tight bulkheads below main deck. Designed and built in accordance with ABS rules for ocean towing service. The vessel carries a USCG load line with a summer free board assignment of 3' – 5/16".

The vessel was completed in 2004 by Southern Oregon Marine of Coos Bay, OR.

PRINCIPLE CHARACTERISTICS

Breadth (mld) -	114' - 9 1/2" 121' - 0" 34' - 0" 19' - 10" 18' - 0" 998 L. T.	Net Tons Gross Tons F.O. Capacity F.W. Capacity L.O. Capacity Bollard Pull	- 134 - 197.0 - 120,000 gal - 10.000 gal - 2500 gal - 120.000 lbs.	ITC 145 ITC 485
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### **MACHINERY**

Main Engine - (2) EMD 16-645-E6; 1950 HP @ 900 rpm

Rev/Red Gear - (2) Reintjes hydraulic Model WAF 1961 5:1:1 ratio

Prop Shafts - 12" dia with oil lub bearings

Propellers - 3 blade R/L outbd turning 114" x 112" in nozzles
Aux Gen sets - John Deere 99 kw each @ 1800 rpm 480v

### **DECK MACHINERY**

Tow Winch - Intercon Model 225 double drum and gypsy with capstan

Wire Capacity - (2) 2600° 2 1/4" dia W.R. Line Pull - 120,000 lbs. at 25 to 200 fpm

Power - John Deere 6068TA w/ Funk series 2000 tq converter and 3 speed trans.

Bow Winch - McElroy Model 528 (1 1/8" wire) w/ 2 capstans

### **MISCELLANEOUS**

Propulsion Controls
- (4) station Mathers air controls
Air Compressors
- (2) Quincy model 340 10 HP

Steering - (2) full redundant systems each with (2) 20 HP Motors

Alarm System - Harris all functions

Air Conditioning - Climate control all spaces Fenders - Bow pud; D-rubber side fenders

Tow Pins - 5 pin SOMAR hydraulic

### **SAFETY & NAVIGATION OUTFIT CALL SIGN**

Radar - (3) Furuno long and short

Radio - (2) VHF's (2) SSB GPS - Furuno RD 30

Fathometer - Data marine sounder Life Raft - 10 man inflatable Elliot

Auto Pilot - Comnav 5000 Satellite Compass - Furuno SC 120